Program Name : **Diploma in Information Technology**

Program Code : **IF**

Semester : **Third**

Course Title : **Data Communication**

Course Code : **22322**

1. RATIONALE

Data communication, which is the transmission of digital data through a network or to a device external to the sending device, is the basis of computer networks. Most of the instruments used in IT can now be connected with network. The Information technology diploma passouts are required to handle the data commumnication related problems. This course examines the important concepts and techniques related to data communication and enable students to have an insight in to technology involved to make the network communication possible.

2. COMPETENCY

The aim of this course is to help the student to attain the following ***industry identified*** competency through various teaching learning experiences:

- **Manage information flow across different communication networks.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Identify process of data communication.
b. Select relevant types of transmission media depending upon requirements.
c. Identify various Multiplexing and Switching techniques used in digital communication.
d. Identify types of transmission error and error correction techniques.
e. Select components of relevant IEEE standards for wireless communication.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	3	70	28	30*	00	100	40	--	--	--	--	--	--

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment.*

5. COURSE MAP (with sample COs, POs, UOs, LOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

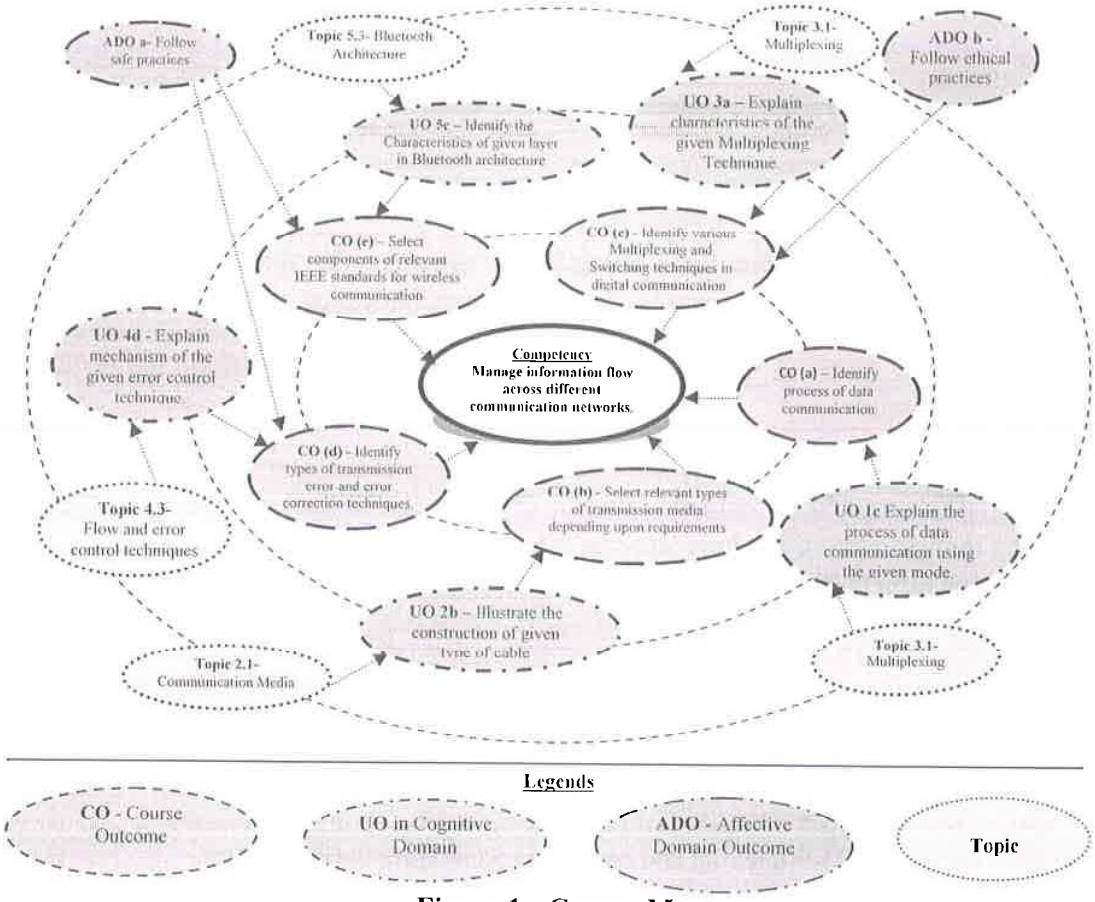

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

Note : No practical Content

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Note : Not Applicable as there is no practical Content.

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introducti on to Data Communic	1a. Explain the role of the given component with the process of data communication. 1b. Compare analog and digital	1.1 Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
ation	signals on the given parameters. 1c. Explain the process of data. communication using the given mode. 1d. Explain the principle of the given Shift Keying technique. 1e. Describe process of analog to analog conversion using the given modulation technique.	1.2 Protocols, Standards, Standard organizations. 1.3 Bandwidth, Data Transmission Rate, Baud Rate and Bits per second. 1.4 Modes of Communication (Simplex, Half duplex, Full Duplex). 1.5 Analog Signal and Digital Signal, Analog and Digital transmission 1.6 Digital-to-Analog Conversion: Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying 1.7 Analog-to-analog conversion: Amplitude Modulation, Frequency Modulation, Phase Modulation.
Unit-II Transmission Media	2a. Describe characteristics of the given type of guided transmission media. 2b. Describe with sketches the construction of given type of cable. 2c. Identify strength/ limitations of the given cable type on the given parameters. 2d. Describe characteristics of the given type of transmission media.	2.1 Communication Media: Guided Transmission Media Twisted-Pair Cable, Coaxial Cable Fiber-Optic Cable 2.2 Unguided Transmssion Media Radio Waves, Microwaves, Infrared, Satellite 2.3 Line-of-Sight Transmission Point to Point, Broadcast
Unit– III Multiplexing and Switching	3a. Explain characteristics of the given type of multiplexing Technique. 3b. Explain working of the given Multiplexing technique. 3c. Explain with sketches the working of the given spread Spectrum technique. 3d. Describe with sketches the working principle of the given switching technique. 3e. Compare different Switching techniques on the basis of the given parameters.	3.1 Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing 3.2 Spread spectrum: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS) 3.3 Switching: Circuit-switched networks, Datagram networks, Virtual-circuit networks
Unit– IV Error Detection and Correction	4a. Explain major functions of the given layer of OSI Reference Model. 4b. Explain with sketches the working of the given error	4.1 The OSI model Layered Architecture Types of Errors, Forward Error Correction Versus Retransmission Error Detection: Repetition codes, Parity bits, Checksums, CRC

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	detection and correction method. 4c. Describe the process of the given type of Framing. 4d. Explain the mechanism of the given error control technique.	Error Correction: Automatic repeat request (ARQ), Error-correcting code 4.2 Framing Fixed-Size Framing Variable-Size Framing 4.3 Flow and error control techniques: stop and wait, sliding window, Go-back-n ARQ, Selective Reject ARQ
Unit –V Wireless Communication	5a. Explain features of the given IEEE standard of communication. 5b. Illustrate characteristics of the given layer in IEEE 802.11 architecture. 5c. Explain with sketches the characteristics of the given layer in bluetooth architecture 5d. Compare given generations of mobile telephone system on the given functional/operating parameters. 5e. Explain with sketches the workingof VoLTE	5.1 IEEE wireless Standards:802.11,802.11a, 802.11b, 802.11g, 802.11n, 802.11ac. 5.2 Wireless LANs: 802.11: Architecture MAC Sublayer, Addressing Mechanism 5.3Bluetooth Architecture: Bluetooth Layers, Radio Layer, Baseband Layer The Logical Link Control and Adaptation Layer Protocol (L2CAP),Smart bluettoth,Near field communication(NFC) 5.4 The Mobile Telephone System First-Generation: Analog Voice Second-Generation: Digital Voice Third-Generation: Digital Voice and Data 5.5 4G and VoLTE, Introduction to 4G and VoLTE, Features of 4G and VoLTE. Next generation mobile communication.

***Note**: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Data Communication	10	04	04	06	14
II	Transmission Media	10	02	06	06	14
III	Multiplexing and Switching	10	02	04	10	16
IV	Error Detection and Correction	10	02	04	10	16
V	Wireless Communication	08	02	04	04	10
Total		**48**	**12**	**22**	**36**	**70**

***Legends:** R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
***Note**: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual*

distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare Comparison table of Multiplexing techniques.
b. Prepare charts for Guided and Unguided Transmission media.
c. Draw OSI Reference model on chart.
d. Library / Internet survey on Wired and Wireless devices.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Use animations to explain various theorems in circuit analysis.
f. Guide student(s) in undertaking micro-projects

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. **Survey on Guided Transmission media:** Prepare a report on recent and widely used Guided media in industries depending on Cost, speed, efficiency, reliability.

b. **Survey on Unguided Transmission Media:** Prepare a report on recent and widely used Unguided media in industries depending on Cost, speed, efficiency, reliability.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Data communications and networking.	Forouzan Behrouz A.	Tata McGraw Hill, New Delhi, 2006. ISBN : 9780-07-296775-3
2	Computer Networks	Andrew s. Tanenbaum	PHI Learning, New Delhi, 2015 ISBN-13: 978-0-13-212695-3
3	Fundamentals of Buisness Data Communication	FitzGerald Jerry, Dennis Alan	Wiley India Pvt. Ltd. New Delhi, 2011, ISBN : 9788126521500
4	Data and Computer Communications	Stallings William	Pearson Education, I nc.,NJ 07458 ISBN: 0-13-243310-9
5	Data Communication and Networks	Godbole Achyut	McGraw Hill, New Delhi, 2006 ISBN : 0070472971
6	Data Communication and Computer Networks	Gupta Prakash C.	Pearson Education. New Delhi, 2006, ISBN: 81-203-2846-9

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

a. www.nptelvideos.in/2012/11/data-communication.html
b. http://www.myreadingroom.co.in/notes-and-studymaterial/68-dcn/750-analog-to-analog-conversion-techniques.html
c. http://www.tutorial-reports.com/wireless/wlanwifi/wifi_architecture.php
d. http://standards.ieee.org/about/get/802/802.11.html
e. www.tutorialspoint.com/data_communication_computer_network/
f. http://iit.qau.edu.pk/books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
g. http://www.studytonight.com/computer-networks/overview-of-computer-networks
h. https://abmpk.files.wordpress.com/2013/04/data-and-computer-comm-8e-william-stallings.pdf
i. https://gradeup.co/flow-and-error-control-techniques-i-28750a29-ba8d-11e5-b537-dcac2f2dd7d1